Contribution ID: **293** Type: **Poster**

First combined analysis of Transverse Kinematic Imbalance data with and without pion production constraints

Tuesday, 18 June 2024 17:30 (2 hours)

As more measurements on various event topologies of neutrino-nucleus interactions become available, Monte Carlo (MC) prediction from neutrino event generators, such as GENIE, shows considerable deviation from some data sets while matching others relatively well. In this work, we present the first global analysis, enabled by the GENIE global analysis framework, of four Transverse Kinematic Imbalance (TKI) measurements on carbon targets with and without pion production, namely $\nu_\mu CC0\pi Np$ and $\nu_\mu CC1\pi^+ Np$ from T2K and $\nu_\mu CC0\pi Np$ and $\nu_\mu CCM\pi^0 Np$ from MINERvA, where $M, N \geq 1$. In both T2K and MINERvA data releases, the authors benchmarked their data against GENIE predictions, except for MINERvA's π^0, in which a GENIE comparison is absent. In the reported benchmarking, GENIE predictions agree relatively well with T2K's $\nu_\mu CC0\pi Np$ and $\nu_\mu CC1\pi^+ Np$ as well as MINERvA's $\nu_\mu CC0\pi Np$ measurements. We use the GENIE global analysis framework with the latest GENIE tune, G24_20i_00_000. The prediction describes the first three measurements considerably well, but it overpredicts MINERvA's π^0. As the TKI variables are excellent probes for nuclear initial states and final state interactions (FSI), we performed a tuning on the reliable Local Fermi Gas (LFG) nuclear model and the hA INTRANUKE FSI model using GENIE Comparisons interfaced with PROFESSOR. The tuning exercise serves as a proof-of-concept practice of using TKI data with and without pion production to constrain model parameters, and the result is stored in a new GENIE tune, G24_20i_06_22c. It gives significantly better prediction for the single π^0 production sample while keeping the same level of data-MC agreement for 0π and $1\pi^+$ datasets. This is accomplished mainly by suppressing π^0 mean free path and the pion charge exchange in FSI. The success of this tuning bolsters the viability of our method and highlights a workable path towards continual model tuning.

First affiliation

University of Tel Aviv

Poster prize

Yes

Second affiliation

Collaboration (if any)

GENIE

Given name

Julia

Surname

Tena Vidal

Institutional email

jtenavidal@tauex.tau.ac.il

Gender

Female

Primary authors: ANDREOPOULOS, Costas (University of Liverpool and STFC/RAL); TENA VIDAL, Julia (Tel Aviv University); RODA, Marco (University of Liverpool); LI, Weijun (University of Oxford); LU, Xianguo (University of Warwick)

Presenter: TENA VIDAL, Julia (Tel Aviv University)

Session Classification: Poster session and reception 1

Track Classification: Accelerator neutrinos